THE COMPUTER BULLETIN

VOLUME 1 - NUMBER 2 - AUGUST 1957

Issue No. 3 (October 1957) will contain the complete Study Group Reports of the London Computer Group for the 1956/57 Session.

THE COMPUTER BULLETIN is published in alternate months, and is issued free to all members of The British Computer Society. Additional copies may be obtained at the published price of each issue from the office of the Society.

Numbers 1 to 3 (June, August & October, 1957) cover the 1956/57 activities of the London Computer Group and the formation of the British Computer Society.

Items of interest to members, announcements by users and manufacturers, and notes of Specialist or Regional, Group or Branch activities should be sent to the Editors, The Computer Bulletin, British Computer Society, 29 Bury Street, St. James's, London, S.W.1.

VINTAGE COMPUTER

Early electronic computers have now been developed long enough for them to join other relics of scientific achievement in that child's push-button paradise, the Science Museum at South Kensington.

The original Pilot ACE, superannuated from NPL, has now found what is perhaps its rightful dower house, where it is displayed in splendid matronly harmony with its neighbouring biplanes, locomotives and other mechanical marvels.

BRITISH COMPUTER SOCIETY NOTES

FIRST PRESIDENT OF THE SOCIETY

As we go to press, the Council of the British Computer Society has announced that Dr. M. V. Wilkes, F.R.S., has accepted their invitation to become the first President of the Society; the appointment is for two years.

Maurice Vincent Wilkes was born in 1913; from King Edward's School, Stourbridge, he went to St. John's College, Cambridge, graduating on the Mathematical Tripos (as a Wrangler) in 1934. He then worked in the Cavendish Laboratory and during the war was engaged on radar and operational research.

Becoming a University Lecturer, and Acting Director of the Mathematical Laboratory, in 1945, he has been Director since 1946 and a Fellow of St. John's College since 1950.

Cantor Lecturer, Royal Society of Arts, in 1951, and Symons Memorial Lecturer, Royal Meteorological Society, in 1952, Dr. Wilkes is well known as an authoritative speaker and author of many published papers in scientific journals.

He is also the author of "Oscillations of the Earth's Atmosphere" (1949) and joint author of "Preparation of Programmes for an Electronic Digital Computer" (1951); his most recent book is "Automatic Digital Computers" (1956).

A pioneer of the design and construction of automatic electronic digital calculating machines in this country (EDSAC I and II being probably the most widely known achievements of the Cambridge Laboratory), the computing art owes much to his work.

APPOINTMENT OF SECRETARY

The Council are pleased to announce that Mr. W.E.Reed, A.C.W.A., A.C.I.S., has accepted the appointment of Secretary to the Society. Mr. Reed was educated at Monkton Combe, and served in the first World War with the London Rifle Brigade. Assistant Secretary and later Secretary to the Briton Brush Co. Ltd., he has been since 1929 a Technical Adviser with Burroughs Adding Machine Ltd.

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BRITISH COMPUTER SOCIETY NOTES

THE SOCIETY'S WINTER PROGRAMME

The Society has planned a full series of regular monthly meetings for the coming session, on the third Monday in each month from October 1957 until June 1958; advance notice has been circulated to all members, and full details will be published in THE COMPUTER BULLETIN. To economise on postal charges separate notices of these meetings will be sent to members only if it is necessary to modify the arrangements.

These are as follows -

21 October 1957 - Professor D. R. Hartree: "The Machine's-Eye View".

18 November - A.J.Barnard: applications of a computer to the work of Norwich Corporation.

16 December - Dr. S.Gill: "Parallel Programming".

20 January 1958 - Dr. N.Levin: "The Physical Principles of Xerography".

17 February - Professor A.C.Aitken: "Mental Arithmetic".

17 March - D. S. Greensmith: (title to be announced later).

21 April - Dr. F.Yates: "Use of an Electronic Computer in Research Statistics".

19 May - T.R.Thompson: "Four Years of Automatic Office Work".

16 June - Presidential Address and Annual General Meeting.

BUSINESS GROUP ACTIVITY

A General Meeting of the Business Group will be held on 23rd October 1957 in the Great Hall of Northampton College of Advanced Technology, St. John Street, London, E.C.1.

Open to all members of the Society, the meeting will discuss, from 3 p.m., the detailed Reports of the Study Groups (of the London Computer Group) for the 1956/57 session; these are being published in the next issue of THE COMPUTER BULLETIN so that they will be in members' hands before the date of the meeting.

Following tea, there will be a further discussion on the experience of 1956/57 as a guide to Study Group procedure for the new 1957/58 session. The full programme of study group subjects to be covered during the coming winter will be given in our next issue.

MEMBERS' DIARY

OCTOBER 1957

7th - Council Meeting

21st - OPENING MEETING at the Senate House, University of London, Malet St., W.C.1.
5.30 p.m. - (Macmillan Hall) Informal gathering of members; coffee and biscuits will be served (no charge).
6.15 p.m. - (William Beveridge Hall) "The Machine's-Eye View", address by Professor D.R.Hartree, F.R.S., with the President of the Society in the Chair.

23rd - BUSINESS GROUP MEETING in the Great Hall, Northampton College of Advanced Technology, St. John Street, London, E.C.1. (open to all members).
3 p.m. - Discussion on Reports of Study Groups (of London Computer Group) for 1956/57 session.
4.45 p.m. - Refreshments in College Dining-Room (charge 2s.6d. per member).
5.20 to 6 p.m. - Discussion on past experience of Study Group activity as a guide to future procedure.

NOVEMBER 1957

6th - Council Meeting

18th - Conference Room, County Hall, London, S.E.1, at 6.15 p.m. (by invitation of London County Council)
Mr. A.J.Barnard, City Treasurer of Norwich Corporation: Applications of a Computer to the work of Norwich Corporation, and Plans for its Future Use.
(The Society has issued a limited number of invitations to members of the Institute of Municipal Treasurers and Accountants and the Office Management Association, to be allocated by the Secretaries of those bodies, and to some of the senior officers of the London County Council.)

COURSES ON COMPUTERS AND RELATED TECHNIQUES

The Society has prepared a list of courses at Technical Colleges, etc., in the London area and in the principle provincial centres, for those wishing to study various aspects of computers and related techniques. Copies of the list may be obtained on application to the Secretary.

SOME APPLICATIONS OF ELECTRONIC DIGITAL COMPUTERS

A. D. BOOTH
D.Sc., Ph.D., F.Inst.P., M.Brit.I.R.E.

From a Lecture given to the London Computer Group on 15th October 1956.
Dr. Booth, Director of Research at Birkbeck College, London University, is a Council Member of the British Computer Society and Chairman of the Society's Scientific and Engineering Group.

INVENTORY CONTROL

1 The first of the computing machine applications with which I propose to deal is that of inventory control. The classical problem which presents itself to the buyer of a large commercial organisation is that of obtaining outside supplies in such a manner as to minimise the total cost to the company. This minimisation can be achieved in a number of ways many of which have to be operated in parallel.

2 Possibly the most obvious consideration from the point of view of the buyer is that of obtaining discount, and in general a larger discount is obtained for batches of considerable size than is available when ordering smaller quantities. On the other hand, if large quantities of stock are to be purchased at one time then the company must provide storage space for these articles and this storage space can be looked upon as invested capital. These are two of the parameters which must be considered when the problem of optimising stores buying is considered.

3 A study of this problem from the point of view of the computing machine has been made in this laboratory, and a simple presentation of it is the following -

Let -

- Q = Total quantity of stock to be ordered during the year
- C = Cost per unit quantity of stock
- S = Cost of storage per unit quantity of stock per annum
- I = Cost of initiating an order
- n = Number of orders initiated during year
- r = Percentage discount for unit of stock
- T = Total cost of operation per annum

Then -

$$T = nI + \frac{SQ}{n^2} + CQ\left(1 - r\left(\frac{Q}{n}\right)\right)$$

$$= nI + CQ + \frac{Q}{n}\left(\frac{S}{n} - CQr\right)$$

(if it is assumed that $r\left(\frac{Q}{n}\right) = \frac{rQ}{n}$)

For minimum cost $\frac{dT}{dn} = 0$

i.e. $I - \frac{Q}{n^2}\left(2\frac{S}{n} - CQr\right) = 0$

And for a real minimum $\frac{d^2T}{dn^2} > 0$

so that $3nS > CQr$

4 In practice the quantity $r(Q/n)$, which represents the discount for bulk purchase, will be a discontinuous function whose value is, say, 5% for (Q/n) between 10 and 100 and 15% for (Q/n) between 100 and 1 000.

5 The effect of this upon the solution is as follows: we take $T = nI + SQ/n^2 + CQ$ as the basic solution. This has the graph shown by the continuous curve (Figure 1). The discount factor $CQr(Q/n)$ is shown by the stepped line, and the resultant by the discontinuous curve.

6 It is clear that the optimum value, in the case illustrated, occurs at D and not at the point M predicted by calculus.

7 Three situations are of importance and these are shown in Figure 2.

8 In cases (a) and (c) the minimum M is that predicted by calculus; whereas that in (b) is at the discontinuity point D.

FIGURE 1

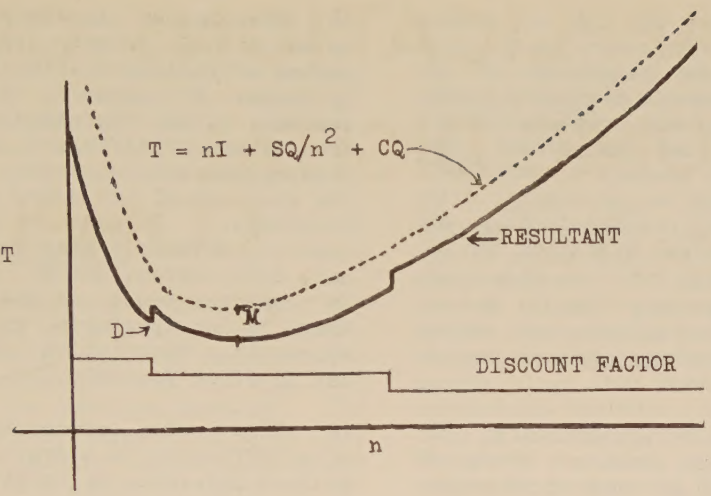
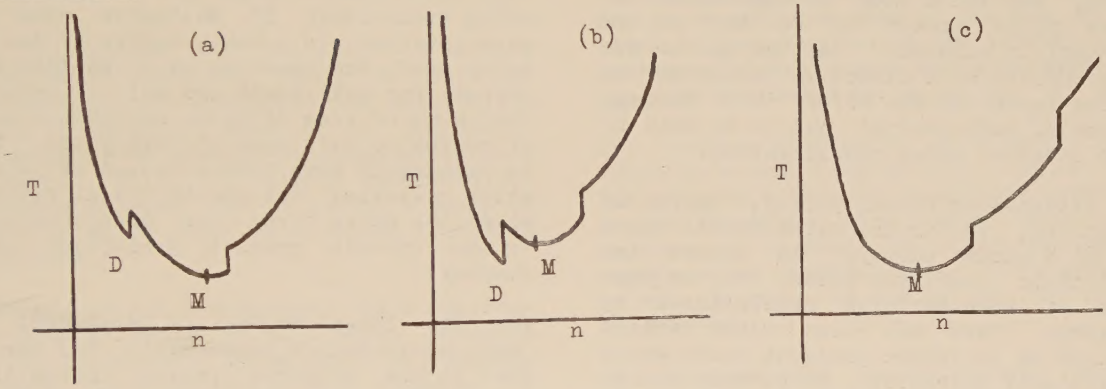


FIGURE 2



9 Because of these discontinuities it appears that the problem is best solved on an electronic computing machine by the following method:

(a) Calculate T(n);
(b) Calculate T(n + 1);
(c) Form T(n + 1) - T(n) = d;
(d) If $d < 0$ store (n + 1) and T(n + 1), or if $d \geqslant 0$ store (n) and T(n);
(e) Proceed to (n + 2), comparing this with the value just stored.

The program is started at n = 1 and stopped at, say, n = 12. The stored results give the value of T(n) and the optimum value of n.

10 Notice that the result may not be unique if D and M have the same value of T; both can be found with this program if it is considered necessary.

11 This treatment is based on a simplified model and is merely given here to illustrate the way in which the program has to be organised. In reality, because money has been used to purchase components, it will not be available for accumulating at compound interest as would normally happen with Company capital under sound financial direction. In addition to this, the program just described deals only with stock of a particular sort, and the problem must be extended to cover the case where a given storage space is available and this is to be distributed in the most economical manner between all the components which have to be bought.

12 At this stage the problem becomes one of considerable magnitude in which the discontinuities which are involved in the discount rates make a rigorous analytic solution quite impracticable. On the other hand by the use of certain self-evident considerations the simple program just outlined can be made to improve greatly the buying oper-

ations of the company.

13 This subject leads naturally to a consideration of the overall strategic planning of the operations of the company. These must be based on what may be called the "Board strategy" of the company s operation, and this may not always be in accord with what would be considered mathematically as correct policy. The ideal situation can be simply described by saying that the object of the operations by any company should be to produce those goods in a single year which will maximise the profit during that period if they are all sold.

14 The planning of this operation up to the point described would involve a study of financial resources, plant and production facilities available, the skills of its operatives, the inventory control situation just described, and would take no cognisance of the sales force except in so far as to realise that it existed. At the end of the planning operation a directive would go to this sales force to the effect that certain quantities of each product had to be sold in the time interval under consideration.

15 An alternative fiscal policy, which is often applied, is for the sales force, as a result of a market survey, to inform the Board of their predicted sales for the year for each of those articles manufactured by the Company. They may also make certain suggestions as to future products which would be particularly saleable. Production policy is then governed by the fact that these articles must be produced, at the times when they are required, at minimum cost.

16 It seems clear that the latter of the two policies is fundamentally the weaker, since whatever else it does it cannot better an optimum usage of the financial and production facilities of the company.

17 When this problem is analysed in detail it turns out that it can be reduced to the solution of sets of linear simultaneous equations by making certain plausible simplifying assumptions to remove non-linearities. The sets of equations so produced relate such things as total cost to the cost of wages, plant, material and so on, and the set of equations is governed by a relationship which says that the total cost of the operation taken in relationship to the total body of business done by the company must be such that the overall profit is maximised.

18 The problem in applying the technique to an actual company is simply that the number of variables involved becomes extremely large. For example, in a reasonable sized company, within the experience of the author, the number of different products which are passing through the works during a period of the year is of the order of some hundreds of thousands. It must be remembered in this context, however, that "product" means every nut, bolt, screw, washer, and so on involved in a major product of the company and that these minor products will not, as such, appear in a description of what the company has to offer for sale.

19 This leads, of course, to a suggestion of a difficulty in overall strategic planning without reference to sales. For example, it might in some cases turn out that a company whose major business was manufacturing motor cars could make a larger profit by manufacturing exclusively $\frac{1}{4}$" Whitworth nuts which were involved in a sub-assembly of the whole motor car. The question as to whether such a company was well based and well equipped from the point of view of motor car production must of course be left open at this point, but it is presumably some consideration of this sort which generates the second fiscal policy in which the sales force has considerable say in the overall product production of the company.

20 The large volume of different items just mentioned is responsible for the fact that it has hitherto proved impossible to attempt the operation of industrial planning on a computing machine. As a rough figure it can be indicated that the largest configuration which can be dealt with at the moment would consist of some 100 or so different products related by linear equations or inequalities. The solution of a problem of this magnitude would require, on the faster machines, a time which varies from 10 minutes to one hour. Since the time of solving any system of this sort varies as the cube of the number of components in the system, it can be seen that the real system would take a prohibitively long time.

21 This gloomy picture does not mean that it is impossible to take any reasonable step to improve the planning of an industrial organisation by means of present day electronic computing machines. It turns out that a number of the parameters have effects which can be considered in groups just as was the case of the single item in the inventory

control problem. By such association in groups and by treating the groups first by themselves and secondly as parts of a whole, it is quite possible to apply a computing machine to obtain information as to the best operation of a company and this seems to be a promising future outlet for these machines.

MACHINE LANGUAGE TRANSLATION

22 The next of the machine applications to be considered is that of translation of languages, and this will at once be seen to deviate very considerably from the type of work envisaged in the previous remarks. It is impossible in a short space to give an adequate account of machine translation which has now developed to a state in which it is possible to effect translation of reasonable quality for texts of a scientific or technical nature.

23 A few remarks may indicate how machine translation is achieved. About 10 years ago the present author considered the possibility of using a computing machine to facilitate the looking up of foreign language words in a dictionary. This is a trivial operation for a computing machine but it led to a study of the results which might be expected from such applications.

24 Merely using the machine as a dictionary is unsatisfactory in many ways, possibly the chief among these being that an ordinary dictionary contains only the singular of nouns, infinitive of verbs and so on. Thus when a word in a real sentence is presented to the machine it is very unlikely that the word will be found as it stands in the dictionary. The use of a real dictionary by a human being presupposes that the human being has a certain basic knowledge of the language concerned.

25 The next stage was evidently to make the machine exercise at least as much judgement as a human being using an ordinary dictionary, and to do this it turned out that the most suitable procedure was to revise the structure of the dictionary itself in such a way that, instead of storing infinitives and so on, it stored stems and endings.

26 A stem is simply defined to be the longest segment of a word which is common to all its parts. For example, for the Latin verb amo t e stem is am and an inspection of a Latin grammar will show that this stem is common to all the parts of the verb. At first these stems were used merely to indicate the meaning of the word so that if, for example, amat was presented to a machine used for translation the machine would simply put love, and perhaps "3 p.s.p.".

24 There was considerable discussion between linguists and computing machine designers as to whether such "translations" were worth while. One school held that merely having a basic meaning of the word would enable the human being using the translation to put it into respectable form, the other maintaining that such translation would be completely useless. It is not worth entering into this controversy at the present time since it has been rendered pointless. The computing machine at Birkbeck College can now take cognisance of the ending which remains when the stem has been detached from the foreign language word and thus correct the English meaning so that it becomes the equivalent of that implied in the foreign language message: in the example which we have taken, amat is translated as he loves.

29 Another difficulty with early translations on a computing machine lay in the fact that it was difficult to achieve lookup times for dictionaries of any size which were not so long as to make the cost of computing machine time prohibitive. This problem was solved by what is now called the method of bracketing.

30 In principle the dictionary stored in the machine is coded in numerical form in such a way that the words occurring in the dictionary form a sequence of numbers whose magnitude increases continuously. The foreign language word to be recognised is coded in the same manner and the number which represents it is subtracted from a dictionary word which is halfway along the dictionary. As a result of this subtraction the difference will be negative if the foreign language word is in the second half of the dictionary and positive if it occurs in the first half.

31 Supposing that the result was negative, then the operation is repeated using a word 3/4 of the way along the dictionary; the same discrimination is again applied and as a result of this a test will be made on the word either at 5/8 or at 7/8 along. This process is repeated until the word itself is located.

32 It is quite easy to show that, with a

dictionary containing n foreign language words, the number of look-up operations required to locate a given word is of the order $\log_2 n$ or, to put this into numerical perspective, with a dictionary of about one million words something like 20 look-up operations are all that is required. Since even slow machines can achieve look-up speeds of 50 comparisons per second it follows that the maximum time for seeking out a word in one of these machine dictionaries is of the order of half a second

33 At Birkbeck College work has been proceeding on the mechanical resolution of French and it can be said that, at the present time, the machine programs have been developed to the point at which it is possible to make translations, from French scientific texts, whose quality could not normally be detected as resulting from other than human operations.

34 Several problems are still under active consideration in the machine translation of language, and perhaps one of the most important of these concerns the application of machines to the translation of many different languages. It is easy to see that, supposing that n foreign languages are to be translated between themselves in all possible ways, $n(n-1)$ dictionaries and sets of instructions are required.

35 This has led to considerable activity among linguists and others directed at the production of a so called inter-lingua or meta-language. That is, a sort of language of ideas into which all languages can be translated and from which a translation can be made into any language. It is easy to see that the number of dictionaries and machine instructions required for a scheme of this sort is $2n$ for the language combinations considered above.

36 On the other hand the argument previously given regarding the bi-directional translation between n languages is in fact spurious, as has previously been noticed by the present author. This is because once translation from all $(n-1)$ languages into and from any one language has been achieved, the whole problem of multi-lingual translation has been solved and the meta-language is unnecessary.

37 It is clear that the number of dictionaries and machine instructions required in this case is only $(2n-2)$ and so is an improvement over that required for the artificial meta-language. Furthermore it is intuitively obvious that if one of the languages is chosen as base then in fact the overall program structure will be simpler than that which is obtained when a separate meta-language is used. It is most unlikely that translation will be simpler if made via a path a-m-b instead of directly via a path a-b, and vice versa.

38 A word is in order regarding the economics of machine translation at the present time. With the computing machine at Birkbeck College, translation schemes for French achieve speeds which are of the order of 1 000 words per hour. With a fast machine it should be possible to increase this speed to about 3 000 words per hour but when the large cost of machine time is considered this still means that the price of a translation is prohibitively high - say of the order of £10 per 1 000 words. Human translation is much cheaper than this.

39 Some consideration has been given to the design of a machine especially for translation with which it should be possible to produce translation rates at least 10 times greater than those possible at the present time. If and when this desirable machine is produced the competition with a human translator will indeed be serious, particularly in view of the fact that, although machine translations are not likely to approach human ones when material of literary quality is to be handled, for scientific texts where it is difficult to obtain competent linguistic assistants the machine may well be superior to a human translator.

SPOKEN WORD RECOGNITION

40 To conclude this brief discussion it is worth mentioning two recent machine uses which may eventually be of importance in the commercial office. The first of these is the use of a computing machine to recognise spoken and printed or typewritten characters.

41 To recognise spoken words the process is in principle simple: the sound waves are converted into electrical wave forms by means of a microphone and suitable amplifier. After amplification they are passed through a set of filter circuits and the output of these is applied to counting elements which determine the numbers of vibrations in different frequency bands which are present

in the initial sound. These numbers are then passed into a computing machine which compares them with previously stored numbers and in this way identifies the sound which is being presented.

42 This picture is of course a gross oversimplification but will suffice for the present purpose. The experiments which have been conducted, so far, have led to the possibility of recognising accurately the spoken digits 0, 1, 2, 3,....9. The more general problem of recognising other words is more difficult but the work proceeding gives some hope that the problem will be solved.

43 The recognition of printed or typewritten characters is of great importance for the application of an electronic computing machine to business problems, but as much has been written on the subject of late it will not be discussed in more detail here.

VOICE-OPERATED TYPEWRITER

44 Once spoken word recognition is brought to a reasonable efficiency, a voice-operated typewriter can be conceived. Such devices have been proposed in the past but have usually failed to attract for two reasons. First, the obvious one that they have worked unreliably, and second, that the results which they produce are in fact phonetic.

45 It has been proposed that the English spelling should be revised to make phonetic typing acceptable, but this does not appear to the writer to be a reasonable solution. If, however, it becomes possible to recognise spoken words on a computing machine, the machine translation programs which have already been worked out will enable phonetic recognition numbers to be compared with entries in a dictionary to see whether they can be directly converted into normal English spellings. If unambiguous recognition is impossible, context can be used to resolve those ambiguities which are not resolvable when only the single word is presented.

46 There seems no reason why, if sufficient encouragement is forthcoming, a voice-operated typewriter of this kind should not be on the market during the next 5 years. The speed of operation of this device would be of the order of one hundred to two hundred words per minute.

47 After this excursion in the somewhat rosy future it may be perhaps salutary to end on a more sober note. Anyone who has tried to make use of dictating equipment - as the present author is doing in preparing this script - will have realised how very difficult it is to produce a spoken text to such a form that it requires no editing. If it so happens that voice-operated typewriters come to the fore it is a sobering thought to consider the verbal excesses which will be perpetrated in the place of our present sober business correspondence.

BRITISH CONFERENCE ON AUTOMATION

The British Computer Society is a member of Group B of the British Conference on Automation. The Conference, sponsored primarily by the three Institutions of Civil, Mechanical and Electrical Engineers, has been set up as a central clearing-house to arrange liason between interested bodies to foster progress in the United Kingdom and to present the British contribution in these fields internationally.

The three groups with their special fields are -

A. Engineering applications of automation,

B. Development and applications of computers, automatic controls and programming techniques, and

C. Sociological and economic aspects of automatic and computation procedures.

STANDARDISATION OF INPUT MEDIA

The British Standards Institution have set up a technical committee to examine the possibility of preparing standard specifications relating to all aspects of punched cards, paper tape, and magnetic tape and film.

Sub-committees, on some of which the British Computer Society is officially represented, are dealing with various aspects of the problem, such as -

the length, width and thickness (with tolerances) of punched cards,

the materials (including plastics) and qualities of the cards,

the coding on cards and tape, and

the shape of holes in punched cards and other factors affecting interchangeability.

EXPERIENCES OF USING A DIGITAL COMPUTER IN INDUSTRY - 2

In the extract from Mr. Griffiths' lecture in our last issue he gave a historical survey of the computer office at Rolls-Royce Ltd., and described their present machine complement and some technical applications. This second part covers financial and production control applications, staff and procedures, training of staff and education of receiving departments, and concludes with some running statistics.

L. GRIFFITHS
CHIEF COMPUTING ENGINEER
ROLLS-ROYCE LTD.

(From a lecture given to the LONDON COMPUTER GROUP on 18th February 1957 at the Caxton Hall, London)

FINANCIAL AND PRODUCTION CONTROL APPLICATIONS

44 Our progress in this field of computer application must be looked at with the background of the Company's complex structure in mind. As you will realise, our factory cannot utilise mass production methods such as are found, for instance, in the car industry.

45 The Derby group of factories are essentially a group of aero-engine development factories which assume responsibility for building our development and early production engines. It is the firm's policy to include technical improvements through modification as soon as they became available - even at an advanced stage of build of an engine. Even our large production factories in Scotland cannot apply mass production methods due to the policy of the latest modification standard being required on all output.

46 This of course means that our product is continually changing - again difficult conditions for control.

47 The structure is further complicated from a computer point of view by the fact that control has to be kept on about 25 000 different parts, some requiring a large number of manufacturing operations.

48 Financial control is currently maintained by use of a variation of the standard costing system.

49 We did however, have one enormous advantage at the beginning of our activities in this field. Since 1937 a large Powers-Samas punched card installation had been developed which, considering the complexity of, and anomalies in, our applications, had brought under control a remarkably wide area of the firm's financial and production control activities. In fact, this installation is currently employed in processing 90 different regular production jobs. Thus in nearly every field in which we looked for suitable computer applications at least some clearing up of the system had been carried out for punched card use. This should not be taken as implying that a good punched card method is necessarily a good one for computer applications.

50 The punched card installation had further eased our entry into financial and production departments by largely eliminating their initial distrust of automatic processing equipment.

51 Responsibility for choosing suitable computer applications has in the main rested with a committee headed by a senior member of our administration and made up of heads of departments that are likely to prove fertile areas for computer application, and representatives of the computer installation. This committee also meets regularly to discuss progress on the various applications. Day to day investigations and methods discussions on the applications are carried out by appropriate members of the main committee and the programmer responsible.

52 Another system we employ is to form two- or three-man teams to investigate applications with a programmer as one member of each team. When the job has been analysed from a methods point of view, broken down into logical steps and all anomalies noted, the programmer then detaches himself from the

team to carry out the detailed programming. It is thus our policy to bring in the programmer at the earliest possible stage of an investigation.

53 As I have already stated, we have used the past 14 months to gain experience of typical data processing problems. Our object has not necessarily been to achieve a number of running productive data processing applications, although where an experiment has proved successful and the basic 650 has the capacity to handle the volume associated with the job, we have naturally run the job regularly as a service to the department concerned.

54 The first commercial application we investigated was a Spares Sales Analysis, the purpose of the job being to relieve the inventory of the cost of spares despatched out of stores and to obtain an analysis of spares sales by type of customer for the commercial contracts department and to supply statistical information for future planning. It was adopted as our first application for the following reasons -

(1) It was a procedure that conveniently formed a complete entity and could be dealt with without making far reaching changes in all directions.

(2) The procedure had already, to some extent, been streamlined and mechanised for punched cards, and as a result much of the preliminary systems study had been done.

(3) The job comprised problems of calculation, discrimination and distribution such as are found in commercial work and was likely to be just within the capacity of the basic 650 computer.

(4) It was also a very suitable job upon which to try out the principles of 'Management by Exception

(5) It was a typical commercial problem which had outgrown previous methods of data processing.

55 The job was initially programmed, before the 650 was installed, by a member of the staff who had no previous experience of computers other than a bare minimum of training on the programming principles of the 650 and, further, he had no experience of commercial practice. The program having been tested, a small proportion of the job was run through on a number of occasions. At this stage it was found that the program did not take account of a number of small anomalies that occurred in the system and also with running experience possible improvements to the program and method became apparent. The job was thus reprogrammed and, although a complete program tear-up was involved, the reprogramming was achieved in a period of two weeks.

56 Further test running took place and subsequently we ran the A.R.S. application for a number of accounting periods in parallel with the existing system during which time a number of improvements were incorporated in the program. We have since suspended the old method of doing this job and the computer is successfully providing the Cost Office with the required information each period.

57 By successful utilisation of the management by exception principle the amount of printed stationery sent to the Cost Office has been cut by a factor of 50 : 1. For, although the computer examines the details of each part, including the manufacturing cost to list price ratio, in far more detail than was possible by conventional punched card equipment, the only information the Cost Office receives is the detail of the exceptional items and a series of cost summaries by labour and material split up into major customer grouping.

58 We have also prepared a number of other programs associated with the A.R.S. application for input to the stores and although these have been proved they have not yet been run independently of the existing systems. We are also looking into the possibilities of going back further into the system to produce Repair Estimates, which will incidentally probably bring into use mark-sensing techniques, and also a detailed Sales Analysis.

59 Other commercial and production control applications that have been tried on the computer include

(a) Staff Salaries,
(b) Stores Control, and
(c) Factory Scheduling.

60 Applications we are actively investigating and/or programming for the new magnetic tape machine include Scheduling, Machine Loading, Stock Control, and Salaries.

61 Summarising our computer experience of commercial and production control data pro-

cessing applications, we can say that all the experiments programmed for the basic 650 computer have been successful in that they have achieved their object within the limitations of the capacity of the machine.

62 We have learnt that very considerable effort is required at the early stage of an investigation to examine the methods and anomalies and obtain a logical pattern for computer application. Indeed this always proves to be far the largest part of the job. It is also interesting to note that not one of our experimental programs included all the anomalies at the first attempt despite great care being taken in the investigation. In an industry where anomalies are bound to occur frequently, it is almost impossible to guarantee that the programming methods investigation will bring to light all the anomalies contained in the system under review.

63 Thus a certain amount of reprogramming or program modification is bound to arise on each computer application over the initial running period. In fact we visualise that none of our data processing programs will remain static.

64 You will have realised that we have not entered this field with grandiose schemes of early integration of data processing but have instead carefully chosen experimental applications which are either small in size and easily isolated or which allow experimental running to be limited to a small proportion of the actual volume. The experience we have gained of these applications on the basic 650 will, however, be invaluable when, in the next few months, we will be loading the magnetic tape computing system with some large scale experiments with a view to possible production running. It is intended to proceed with applications of individual jobs, bearing in mind possible integration, but not to plan for a completely integrated whole.

65 One of the biggest obstacles that we will have to overcome if we are to be successful in our large scale data processing applications is the difficulty of rapidly and accurately raising information from the factory floor. Currently there does not appear to be one answer to this problem either in existence or on the drawing board. It may be that the answer lies in an integration of a number of devices. It is hoped that data processing equipment manufacturers will devote sufficient of their resources to ensure that advancement in this field is compatible with computer development.

STAFF AND PROCEDURES

66 The 43 members of the current staff are made up of 16 programmers, 6 computer operators, 2 auxiliary machine operators, 9 key punch and 6 verifier operators, a punch and verifier supervisor, one typist, the Deputy Chief Computing Engineer and myself.

67 The programmers are almost entirely honours mathematicians, a few of whom have research qualifications. They are split up into three sections, each with a Section Leader in charge. There is a Numerical Analysis Section, with a complement of 5 staff including the Section Leader, which is responsible for the programming of technical and data processing applications which involve advanced numerical analysis techniques. In addition this section programs routines and sub-routines that have frequent application in the work of the two other sections.

68 Another section with a complement of seven, and called the Technical Section, is responsible for the programming of work from the technical and engineering departments of the Company.

69 The third section is responsible for the programming of commercial and production control work for application to the computer.

70 We have adopted the principle that a programmer should be responsible for an application from its inception until it has been tested on the computer and subsequently handed over for production on the computer to the operating staff. We are thus opposed to the idea of splitting up the responsibility of programming an application between two grades of labour, namely programmers and coders

71 When assuming responsibility for a new application a member of the Technical Programming Section is expected to obtain a thorough knowledge of the work before he begins to program. He must know why the department concerned want to do the job, the engineering 'know how' and theory behind the work, and what the department concerned hope to get our of it. By use of these methods and also because in the early days a hard core of our programmers were mechanical eng-

ineers, we have been able to give our mathematicians an appreciation of engineering method and intuition and have as a result increased the value of their work by a considerable factor.

73 It has further been rather noticeable that as a result of these methods, programmers have often made useful contributions to the engineering method of an application by applying knowledge they have gained from previous programming work in associated fields.

73 We encourage the technical departments of the Company to include, with a request for programming action, other work, a write-up of the job, giving the basic theory and calculation layout. They are also asked to include in the write-up any practical engineering details that may help in appreciating the problem and to specify the ranges of numbers occurring in the calculation, and any answers, final and intermediate, that they require printing or plotting. They are also asked to include specimen calculations which are used for checking purposes when the programmer gets to the testing stage. Every effort is made also to obtain from the technical departments an indication of the points in a calculation which they may possibly wish to add to or change with experience. The programmer is then often able to program these areas of the problem in a manner which will considerably simplify any further alteration or addition.

74 Before programming an application involving a component on the test beds, the programmer is encouraged to see the component or test cell in action - again with the object of ensuring that he has a real conception of the problem at a very early stage.

75 The problems of the Data Processing Programming Section are naturally somewhat different but here again we have chosen the staff from Honours Mathematics Graduates, not because they are required to use their mathematical training directly on this type of work but because we have found that, with the logical background they have obtained as a result of their studies, they are better able both to contribute to the logical survey before programming begins and are also able to arrive at a more efficient program. With the necessity of using optimum programming techniques on the basic 650, there can be a factor of 2 : 1 or even 3 : 1 between the running time of a first class programmer's work and that of an average programmer. The factor will be somewhat reduced with the magnetic tape system but we are sure that there will still be a considerable difference. Again it is essential with our very large computing requirement and the current high cost of computers that every program should utilise the computer in the most efficient manner.

76 The commercial and production departments that have come into contact with the programmers on the applications so far investigated have all stated that rather than being hindered by our use of mathematicians, they have found that the programmers have been able to approach the systems study with an open mind and, after a relatively small amount of experience, are able to make extremely useful contributions at the methods study stage in addition to turning out first class programs. This is significant when it is realised that all our systems are necessarily extremely complex by the very nature of our business.

77 The work of the Numerical Analysis Section in programming jobs involving the application of advanced numerical analysis techniques and of providing a service of routines and sub-routines to the other two programming sections requires no elaboration here other than to say that they are often required to produce original work particularly in some of our reactor and aero-engine engineering applications.

78 At the actual programming stage all the Programming Sections use essentially the same techniques. They are required to produce detailed block diagrams before any machine instructions are written. We estimate that the time taken on the block diagrams should represent about 65% of all the time taken on program writing.

79 Block diagramming is usually split up into a number of stages. In the first place a programmer draws up an 'overall' block diagram which contains the read procedure in detail if more than one card form is involved, and the main computation blocks as single item entries with block connection and looping procedures in detail.

80 Each of the main computation blocks is then block diagrammed in detail. We find that in large programs the equivalent of about 300 instructions is a convenient size for a computation block.

81 As the 650 contains built-in checking features for all operations we do not include extensive checking in our programs other than that required to check that the human operator has correctly performed all the manual operations required to provide the machine with data and initiate the computation. We do, however, include overall checks where these are convenient.

82 We have found the checking features of the machine to be completely reliable as, whenever an error has occurred, the machine has always stopped on the instruction in error. The fact that we do not have to include extensive checking in our programs implies that we can more efficiently use the storage capacity of the machine for instructions and data, and we also achieve better operating times than we would if the machine did not have this facility.

83 As it is vital from a machine utilisation point of view that programs which are to be used frequently should be tightly optimised, we restrict the use of interpretive routines, which can in general only achieve a program which is about 75% optimised, to those one-off jobs where it is important to obtain a solution quickly.

84 Program testing periods are limited in duration to half an hour. No attempt is made to test a large program in a half hour test period, but instead programs are tested in blocks which as far as possible coincide with the detailed block-diagram blocks which are of approximately 300 instructions in length. No programmer is allowed on the machine for a test period unless he is equipped with a full set of check calculations.

85 Inefficient utilisation of testing periods by excessive use of console switching is strongly discouraged. At the same time we regard non-selective use of tracing routines as equally wasteful. We tend to use a non-selective tracing routine to analyse a maximum of 20 instructions. On the other hand we have available selective routines which are used to analyse particular types of instructions over whole areas of the program.

86 When a programmer has thoroughly tested his application he produces a program report which includes instructions for operating the job on the computer, a brief write-up of the theory of the job, the complete block diagram, and a full copy of the program. Copies of the program reports are retained by the Computer Operating Staff who are organised into three two-man teams for operating the computer on a three shift basis.

87 The academic qualifications of our computer operating staff vary between Higher National Certificate and Pass Degree standard. We have found that it pays to use operating staff of this standard in an installation such as ours where there is a large number of varied applications programmed for the computer, and they are required to understand programming to enable them to diagnose trouble during production running.

88 The overall organisation of the flow of work through the computer and standard punched card equipment, and the allocation of program testing time, is one of the responsibilities of the Deputy Chief Computing Engineer. It is important that this responsibility be allocated to a senior member of the staff as naturally there are always conflicting interests, both internal and external to the department, particularly for computer time.

TRAINING OF STAFF AND EDUCATION OF RECEIVING DEPARTMENTS

89 The rapid increase in the numbers of the Computer Office Staff during the past year naturally created a number of problems especially as we had to cater for a ratio of new/old personnel of over 3 to 1.

90 We devised a training scheme for our programmers which was divided into three stages. In the first place the new programmer spent the first week of his employment learning the standard punched card equipment. We regarded this part of the training scheme as very important because properly devised punched card auxiliary machine procedures are an invaluable aid to efficient operation of a computer with punched card input/output facilities.

91 At the end of a week's practical training on the punched card equipment, the new intake was transferred to the Programming Room where he was attached to one or two of the small core of experience we had previously built up. The training at this stage took anything from one to two months, depending on the individual. This was not entirely an unproductive period from our point of view as almost without exception, for the last 50% of this period, the new programmer was engaged on a program which would subsequently be used

on the computer.

92 As we could spare staff we further attached the programmer to IBM three-day introductory courses on the 650 magnetic tape computing system that will be installed in the near future; this being the third phase of the training programme.

93 It is important to note that we do not regard this short training scheme as having turned out first class programmers. We are convinced that it takes anything from twelve to eighteen months for a man to become a really first class programmer.

94 We do, however, encourage in every way possible an interchange of ideas between our programmers with the object of assisting in turning out the first class product. One way in which we do this is to hold regular programmers' meetings at which we interchange ideas and also discuss any awkward problems that have arisen in the interval subsequent to the previous meeting.

95 For the training of our other staff (Computer Operators, Auxiliary Machine Operators and Verifier Operators) we have relied entirely on our own resources.

96 We have, however, not restricted our educational efforts to our own staff as in the past six months we have run two courses, one for members of the technical departments of the Company and the other for staff within the commercial and production departments.

97 The objects of the course for technical departments were as follows:

(1) We were frequently receiving work for programming from the departments in an indigestible form because they had not taken the trouble to define their job properly. One object of the course, then, was to show them how they could cut down the programming time to our mutual benefit by providing where convenient a full write-up of the work to be programmed, which would include a statement of the problem, a check calculation for program testing convenience, an indication of the numbers of digits occurring in the intermediate and final results throughout the problem, an indication of answers they require printing or plotting, and an indication of the parts of the problem which are likely to require alteration or additions with experience of running the job. We realised that it would not always be possible to provide all this data, but we did want to emphasise its usefulness to us when provided.

(2) The second object was to give them a better knowledge of the possibilities of the equipment.

(3) We wanted to indicate the possible areas of advance in the future. That is, areas where the application of a computer is not obvious but very worthwhile and also to indicate the improvements likely to be gained with possible advances in equipment.

(4) Lastly, we wanted to overcome any distrust or inertia that remained against the use of a computer. We felt the best way of doing this was to educate them and also to encourage them to believe that they are an indispensible part of our service.

98 The objects of the course for commercial and production departments were very similar except that here we were more concerned with breaking down inertia and distrust born of lack of knowledge of data processing equipment and its application.

99 On both these courses we explained in simple terms the purposes and use of the various components of a general purpose computer, gave a brief introduction to programming and discussed in detail a number of applications.

100 The total attendance on these courses was approximately 120. On each occasion the members of the course were drawn from departments likely to benefit from computer application and every effort was made to choose the more senior members from each department.

101 The value of these courses is being made evident to us every day and we regard them as extremely successful and worthwhile ventures despite the fact that we had to stretch ourselves to organise them, as they came at a time when we also had considerable domestic training problems.

RUNNING STATISTICS

102 In the past twelve months the programming sections have completed 125 programs of which 92 (that is 73.6%) were major programs and not utility routines. Naturally the vast majority of these are for technical applications.

103 The electronic circuits of the 650 include 2 000 valves and 4 000 germanium diodes. In the 14 months that we have been running the machine, no germanium diodes have been replaced and only 25 tubes have been changed. Of these 25 tubes, 9 were replaced during scheduled maintenance.

104 In order that you may have a good idea of our running statistics I have some figures for the last 13 weeks' running.

105 In this period the machine has been put to good use for either production or program testing purposes for 1 680 hours. This figure does not include the time taken for scheduled maintenance or unscheduled breakdown. Over and above the total of 1 680 hours, during which we ran the machine to good purpose, we had a total of 5.3 hours unscheduled breakdown.

106 These records amount to the fact that over the last 13 weeks we have used the computer for an average of 129 hours per week and on top of this the unscheduled breakdown has averaged out at 24 minutes per week.

107 Looked at in another way the machine is down, apart from scheduled maintenance, for .315% of the time, that is, its running efficiency is 99.685%.

108 It should be noted that this record includes the down-time due to electro-mechanical failures on the card input/output unit.

LONDON COMPUTER GROUP — ANNUAL MEETING

The first, and also the final, annual general meeting of the London Computer Group was held at the Royal Festival Hall on the evening of 19th June 1957, when nearly 200 members attended.

The Chairman of the Group, Mr. D. W. Hooper, presided, supported on the platform by members of the Committee and the joint Honorary Secretaries.

After the notice convening the meeting and the report of the Honorary Auditor had been read, the Chairman moved the formal adoption of the Report and Accounts, previously circulated to members.

CHAIRMAN'S ADDRESS

In his address, the Chairman said:

"You have already received a copy of the Committee's Report for the period ending on the 30th April 1957, and I do not therefore propose to repeat in detail the information that is contained in that Report. But I do welcome this opportunity of amplifying some matters which it has only been possible to refer to briefly within the compass of the Report, and of bringing you up to date so far as I am able in current development of our activities.

"The initial response to the formation of the London Computer Group was most encouraging; those of you who were present at the inaugural meeting will remember how the attendance then exceeded all expectations of the organisers, and the growth since then, to a total of 479 at the 30th April and subsequently to 519 up to this morning has shown the need for an organisation embracing the interests for which the London Computer Group was formed.

"Financially, your Committee regard the position as satisfactory, even though the rapid expansion of membership to which I have just referred soon made it apparent that we could not give members the service they required or run the affairs of the Group to their satisfaction solely with the assistance of voluntary officers; expenditure in consequence rose sharply. In fact, at one time during the year the organisation of the Group's many activities and the recording of increasing membership nearly became uncontrollable. It was necessary to set up a permanent secretariat and to put membership onto a sound financial basis.

"You will remember that the Committee circulated its proposals to members just be-

fore the end of 1956 and these proposals were accepted by such an overwhelming majority of members that the proposed arrangements were put into force from 1st January this year. It was unfortunately necessary to suspend temporarily the enrolment of new members for a short period while staff were being recruited and the Group's internal affairs placed on an efficient basis, but even so we were able to show a small surplus on the year's activities, preserving intact the subscriptions we had received in advance.

"The position at the moment, in round figures, is that expenditure since the 30th April has been kept within the income represented by the relative proportion of current subscriptions, and at the 31st May we had funds amounting to some £1 200, mainly representing the unspent proportion of subscriptions already received; much of this is, of course, earmarked for specific expenditure which we know will arise.

THE GROUP'S ACTIVITIES

"The activities of the Group during the year have been detailed in the Report and I venture to suggest that for the first year of a new organisation such as this they make very creditable reading.

"We have been privileged to hear a notable series of lectures and I must here record the Committee s appreciation of the time and trouble given to the Group by the many experienced and eminent speakers. Not only were they called on, occasionally I must confess at rather short notice, to present a paper to a critical audience, but we also prevailed on some of them to produce a written script or to edit a recording of their talk. Some of these lectures will be reproduced in The Computer Bulletin, about which you have been told so much and have seen so little.

"We are very conscious of not having produced the Bulletin before now, but there are several important factors. Firstly, it does take a busy man some considerable time to edit a talk into a form suitable for publication. Secondly, in many cases the products of a particular manufacturer are referred to, and further delay is occasioned in agreement with him. Thirdly, we do want to be as sure as we can that the Bulletin will be largel. self-supporting, so we have had to approach potential advertisers on a string of promises and a lot of faith; I must say that some of them have responded magnificently.

"But the main factor which has delayed publication has been the comparatively swift progress over the past few months in discussions on the formation of some national organisation. Your Committee did not consider it advisable to shout the success of the London Computer Group too loudly from the house-tops through the medium of a new publication just at the critical time when such a step might have caused some, who do not regard London as the hub of the universe, to temper their previously acknowledged sympathy with the objects of the Group with some reserve in associating themselves with what might to them appear to be a rather parochial organisation!

"I do not propose for the moment to make more than a passing reference to the Study Group activities, with which so many of you have been so closely associated, because I am asking Mr. Dowse, as Chairman of the Study Group Sub-Committee, to tell you something about them shortly. But having then, of the four objects for which the Group was formed, dealt with two and remitted one to my colleague, I wish to devote the remaining minutes of my time to saying something about the work which your Committee has been doing in (and here I quote) 'cooperating to the fullest possible extent with other bodies with a view to the formation of some national organisation ."

THE BRITISH COMPUTER SOCIETY

The Chairman then gave an account of the events leading up to the formation of the British Computer Society (reproduced in substance as the leading article in the June issue of THE COMPUTER BULLETIN). Commending the Society to members, he continued:
"You will appreciate that there are many details of organisation of a national body on this scale which are still under discussion and which still need to be worked out with considerable care. But your Committee are confident that the proposed arrangements are in the best interests of all members and that, by the Committee of the London Computer Group becoming the Committee of the Business Group of the British Computer Society, the special interests of those primarily interested in clerical and accounting data processing will be safeguarded. If I may put it colloquially, you have nothing to lose and everything to gain.

"This first Annual General Meeting of the London Computer Group is therefore, if you accept the proposals of the Committee set out in the Report, also its last. I have, however, no sense of shame or regret, but in fact look back, and look forward, with some pride, because I feel that the Group has achieved a good deal in a short time, and has been a not unimportant factor in the emergence of a national society, founded on sound principles, and owing not a little to the experience we have gained over the past year.

THE NEW COMMITTEE

"The retiring Committee of the Group was appointed at the inaugural meeting to serve for a term of one year. They have all signified their willingness to stand for re-election, and when, prior to the formation of the British Computer Society, members of the Group were asked to nominate additional names for election to the Group Committee for the ensuing year (on the assumption then that the Group would continue as a separate entity) only four nominations were received.

"Our experience in the past has been that there is always more work than there are Committee members available; you will appreciate that we all have loyalties to employers which must come before the affairs of a voluntary organisation, and it has at times been most difficult to find time for all the jobs to be done. When your new Committee, as proposed, becomes the Committee of the Business Group of the British Computer Society, with the need to find representatives to serve on the Council of the Society, on the Committee of the Scientific and Engineering Group for cross-fertilisation, and I have no doubt on many other bodies, we recommend that the size of the Committee should be increased at least for the first year of the new arrangements.

"The Report therefore contains the proposal that the existing Committee, together with the four additional nominations, as named therein, should be the Committee of the London Computer Group for winding up its affairs and should then be reconstituted as the Committee of the Business Group of the British Computer Society.

THANKS TO COMMITTEES AND STAFF

"I must now express my personal appreciation to the members of the Committee (and I know I am speaking also on your behalf) for the immense amount of work and effort they have each and every one put into the Group, both in developing this new project and in realistically approaching this concept of a national organisation. I do not intend, and I do not think they would wish it, to single out any one individual, but there are two exceptions: our two Honorary Secretaries, Tony Bray and John Hough, without whose immense labour much that has been achieved would never have been attempted.

"The great majority of our members have been associated with one or more of the twenty-four Study Groups, and I must publicly express the Committee's deep appreciation of the work done by Convenors and others in running these Groups; we regard this as the most important activity that the Group has undertaken over the past year and the one that has done most in bringing members together. Without the ready help and hard work of the Convenors this activity could not have prospered as it has, and it is good to know that the Study Groups will continue under the auspices of the Business Group of the British Computer Society.

"We are also grateful to the two members of our secretariat, Miss Daphne Aldis and Miss Jane Auld, who have so 'integrated' themselves with the life of the Group that they have cheerfully worked long hours and done much beyond the strict line of duty to ease the burden on the voluntary officers and Committee.

RETIREMENT OF CHAIRMAN

"I would like to end, if I may, on a personal note. I have been deeply appreciative of the honour you did me in electing me your Chairman at the inaugural meeting. It has been a great experience to watch the development of the Group and to have played some small part in it; it has been richly rewarding to see the gradual and ever-increasing acceptance of the Group as a body of standing in many surrounding fields beyond the strict limits of our immediate interests. And I must pay tribute to the loyalty and help given to me personally by my colleagues on the Committee, and by many other members whom I have met from time to time, although not nearly so many nor nearly so frequently as I would have wished.

"The Council of the British Computer Society have now honoured me with an invitat-

ion to become their Chairman of Council; this I have accepted, and I have therefore informed your Committee that I would prefer not to be asked to take on any office within the London Computer Group or the Business Group of the Society. I feel my job lies in observing the utmost impartiality between all interests, however these may develop, whatever difficulties may arise.

"I do not, however, fell that I am in any way taking leave of you, but rather of moving with you into wider spheres where we can pursue one common object which we all have at heart, participating actively in the affairs of a new organisation which I am confident will not only serve our individual needs and interests but will develop into a body of national importance, expressing a national viewpoint, and contributing, I dare to suggest, in no small way to the development of British industrial and management efficiency.

"It only remains for me to move formally the adoption of the Report and Accounts, and of the proposals contained therein. I call on Mr. R.G.Dowse to second the Resolution."

WORK OF THE STUDY GROUPS

Seconding the Resolution, Mr. Dowse referred briefly to the activity of the Study Groups in 1956/67, and continued:
"It is important, I consider, to appreciate our view of the main purpose of the Study Groups: to provide a forum for discussion for people with common interests. It is in the light of this purpose that the activities for the past session should be viewed.

"The difficulties facing us at the outset were formidable. We did not know the subjects which would interest our members. We could not predict the level of attendance. We did not know the extent of our members' technical knowledge. We did not know where the Groups would be able to find meeting places.

"We therefore proceeded on the basis of trial and error, and inevitably some errors were made. However, we are now able to say with some confidence that the Groups have operated very well.

"The main credit for this is due to the Convenors, who have worked so hard and so enthusiastically throughout the session, and also to those who have helped us in providing meeting places and other facilities.

"The lessons we have learnt from the operations of the past session may be summed up as follows. Firstly, the subject matter of each Study Group should be defined as closely as possible. This has two objects. It enables Groups to focus their attention to the subject from the beginning of the session, so that they do not waste time in attempting to define what they are to discuss. Also, an accurate definition of the subject matter enables members to select and join those Groups to which they will be able to make a contribution and in which their main interests lie.

"The second lesson that we have learnt is that the membership of each Group should be increased slightly. Last year the average membership was about 19, and we propose to increase this to 25 - 30. On a basis of 40% attendance this should give a sufficiently large number of members at each meeting to afford reasonably full facilities for debate.

"Last year we appointed Convenors for the Study Groups, but in future we propose to appoint Chairmen and to leave the administration of the Groups and the choosing of their officers to the Groups themselves. We think that the appointment of chairmen of study groups is more in accord with the status of the Society.

"There were a number of other administrative points on which we have learnt valuable lessons, but I have summarised the main points of principle, and the Committee will pay attention to these in the coming session.

STUDY GROUP REPORTS

"As I have said, the main purpose of the Study Groups is to enable members with common problems to meet and discuss. Each Group has prepared a Report which was intended mainly for the members of that Group, but many of these reports are so interesting that we felt that they should be made available to all members. We have, therefore, edited them and we propose to publish them in The Computer Bulletin.

"The principle that we have followed in editing is to consolidate the reports of groups working in the same subject. The reports will be anonymous. However, in some cases, where the separate reports show interesting differences in treatment, we intend to publish the separate reports, but we shall still preserve anonymity.(continued on page 42)

BOOK REVIEWS

NO-MAN'S LAND BETWEEN ENGINEER AND ACCOUNTANT

APPLYING ELECTRONIC DATA-PROCESSING TECHNIQUES

By Dudley W. Hooper, M.A., A.C.A.*

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In this electronically evolutionary world of to-day the plain man finds himself in some difficulty. If he is a plain electronic engineer, should he try to appreciate the ramifications of, let us say, management accounting techniques based on actuarial evaluation of statistical data; if he is a plain accountant should he attempt to follow the higher mathematical flights of those to whom programming a computer is considerably easier than solving *The Times* crossword; or, if he is just a plain business man, where does he start?

A survey of the many books, conference proceedings, periodical articles and manufacturers' literature produced over the past year shows clearly that these are generally the three targets at which most writers and speakers aim. The National Physical Laboratory's treatise *Wages Accounting by Electronic Computer* (H.M.S.O) typifies the scientific approach to the problem, treating the progression from original data of time and work through to the pay packets as just another mathematical problem. R. G. Canning, in his *Electronic Data Processing for Business and Industry* (Wiley), emphasises that the every-day data-processing needs of industry are suitable work for electronic techniques, and writes something that the electronic specialist can appreciate as an exercise for the application of his technical knowledge. George Kozmetsky and Paul Kircher, in their *Electronic Computers and Management Control* (McGraw-Hill), attempt to review, for general reading by the plain man, both the technique and its application.

Any one asking which is the right approach would probably receive the answer "it all depends." But there is one thing certain—a need for much greater understanding between the electronic specialist on the one hand and the management-user on the other. Both are attempting to approach common problems from different standpoints, to meet with mutual understanding in the middle field of computer technology.

* Chief Organising Accountant, National Coal Board; Chairman, London Computer Group.

This difference of approach is typified by the development of electronic data-processing equipment: on the one hand downwards from the universal automatic electronic digital computer, and on the other hand upwards from orthodox punched card equipment.

And that is why, of the three, I prefer Kozmetsky and Kircher. While they state frankly in their preface that their book is written primarily for the business executive, it would not hurt any engineer to absorb the difficulties apparent on careful reading of management requirements.

But in this middle field, somewhere between clerical data-processing as a simple routine job, and the pure mathematical or scientific computation, computer techniques can and are being used to give management a service of effective information that was not previously available, or was only available at great cost and after such lapse of time as nullified its worth. Further, they give management an opportunity to integrate all requirements from one initial recording of basic data and, while the complexity of calculation in normal management accounting is very slight, the volume of processing to be done on any one individual item of information—when expressed in mathematical terminology—can produce a formula of formidable length. Both of the American books emphasise, rightly, the difficulty of preparing initial input, and the need for pre-organisation of input if one is to avoid elaborate equipment which itself becomes a giant sorter and little more. They also stress that from one initial record of a man's attendance, work, and materials consumed—with automatic consultation of standing data by interrogation—it is now possible to give a complete picture of production, labour and material consumption, and all related information, to guide production management. Subsequently, because the information happens to be readily available the installation can be used to compute each employee's net pay and other orthodox historical accounting requirements. The more mathematical approach, typified by the National Physical Laboratory publication, tends to ignore these other implications. It deals primarily with the need to determine the payment to be made to each employee each week. But in most concerns, as methods of processing are improved, as the need for management accounting and control techniques increases, so the mere calculation of net wages becomes almost an afterthought to the main operation—establishment of labour costs, quantative labour statistics and production control data.

The reason for this confusion of thought is not hard to find. The scientific or mathematical problem, as presented to the programmer, is already in arithmetical form. The analysis of the problem, its rearrangement to give the most economic working, are arithmetical jobs for which the mathematician entrusted with the coding is eminently suited. The engineer naturally regards the whole as part of the programming operation. But in clerical data-processing, the analysis of the problem, its economic rearrange-

So it is apparent that the accountant (and by this I mean the management accountant in industry providing a service of information to management) is now becoming almost a systems engineer. There is no particular mystery about computers, there is no magic; what is needed is sound appraisal and a good systems job. But it is on this point, where systems appraisal ends and programming begins, that there is a great deal of confusion and lack of definition. Much of what is normally termed "programming" in the field of electronic data-processing is nothing more or less than a first-class organisation and methods flow-chart, showing precisely what happens to each piece of data within the computation process, expressed in plain English; admittedly, this requires some understanding of the capabilities and limitations of the machine, but no more than that. Only when this has been done, and linked with a similar preliminary flow-chart for the translation of the original event into the medium in which the computer can operate, can true programming, or coding into machine language, commence. Even Canning himself is confused on this point as in one place he follows this concept, whereas in another he clearly from the context is referring to the complete appraisal as a part of programming.

ment and its planning are organisational jobs. Not until the problem has been shaped so that it can be expressed arithmetically can true programming start.

Both of the American books are helpful in giving a clear picture of what "integration" means, and therefore what service a computer can give to management; equally valuable, they give the scientist and mathematician a clear concept of the sort of problem they are up against when applying a mathematical tool to the exercise of clerical judgment. But both books lead one again and again to the question how much should management know about electronic techniques and how much should the engineer know about management techniques?

There is then, clearly, a need for an integration of interest: a means whereby management, control specialists, production engineers, accountants, designers, statisticians, technicians and engineers can work as a team in evolving data-processing installations, can exchange information, can work towards clearer understanding of each other's problems and, perhaps most important of all, can establish a personal feeling of trust in each other's appreciation of their own problems.

None of the authors suggests how this might be done or indeed really faces up to the problem. There are in this country many conferences sponsored by professional bodies to which representatives of other professions are invited; professional bodies in different spheres of activity exchange information and consult, at council level, on common problems affecting their professions. The need is more for the common man to be able to meet his opposite number—the ordinary specialists in each field to rub shoulders with, to argue with, and to discuss particular applications and problems with each other. It is in this field that there is undoubtedly room for some organisation of individuals from all types of experience and qualification but with a common interest in the design, manufacture and use of electronic computers and data-processing equipment. I purposely say individuals. While managing councils and committees undoubtedly have a great part to play in this field by correlating their activities and interest, it is only at the level where the ordinary individuals sit round the table in group study and hammer out their differences that real understanding of the problems on both sides will be achieved.

And what problems there are—in some cases partly because of this lack of mutual understanding and appreciation. Electronic techniques are being developed, computers are being evolved to be more reliable, more compact, more efficient, more economic. But the translation of information into the computer medium, the organisation of related processes, the absorption of a computer into the day-by-day operation of a business—these are some of the problems neglected by engineer and manufacturer. It is still true that the larger proportion of the work involved in devising an electronic data-processing procedure lies in the simple organisation of the job and a very much smaller proportion in the method of computing it. We are still far too dependent on the mechanical and electro-mechanical devices which at the present time have of necessity to be associated with an electronic tool before that tool can be effectively operated; here surely is a problem which can only be resolved by clear understanding by the technician and designer of the user's needs.

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The Management Approach to Electronic Digital Computers. By J. Sandford Smith, A.C.A., M.I.I.A. 1957. 227 pp. $5\frac{1}{2} \times 8\frac{1}{2}$ ins. (London: Macdonald & Evans.) 35s. This is the first significant English book on computers to be written mainly for management and it therefore merits a detailed review. The author has had wide experience in financial administration and consultancy and he sets out to give chief executives a basic appreciation of what a computer might offer to an organisation and some idea of the price to be paid in money and training.

The first part of the book outlines the development of statutory and management accounting and explains what a computer is. In assessing the special contribution which a computer can make there is considerable emphasis on speed and perhaps not enough in these early chapters about its ability to discriminate. The possibilities of a "one-shot" process are reviewed and the author appreciates that American projects of this kind will take some time to reach maturity.

From the management viewpoint the most important part of the book is probably that covered by parts of chapter 10 and the subsequent chapters. The impact of a computer on organisational structure is fully discussed, the possibilities of a *realtime* application are appreciated (the train of activities which follow receipt of a customer's order) and the professional auditor is reassured that life will not be too difficult if a firm grip on principles of accountancy is maintained.

The assessment of computer progress in the United States of America is based on a visit made by Mr. K. Elbourne in October/November, 1956. The reviewer cannot agree that in America work on the logistics of industry has preceded humdrum commercial documentation, whereas we in Britain are tackling the humdrum first. Most American companies have started with payrolls and existing statistics and, despite much talk, with few exceptions have not yet achieved significant modifications in output compared with what they already had from their vast punched card installations. We know several British companies which are planning management information systems (in preference to payrolls), and J. Lyons & Co. Ltd. are already enjoying such routines. The chapter on the social significance of the computer is well supported with statistics and calculations of clerical redundancy to be expected in manufacturing industry and nine other groups of business.

There are eight chapters on the inner workings of computers which are written in a language which the non-technical reader can easily understand, but which nevertheless will have to be read attentively. Occasionally there are a few minor possibilities of misunderstanding. For example, on p. 34 it is alleged that punched tape verifiers cannot produce a printed check on what the operator has done. The technique of modification of orders deserves more space than the short paragraph on p. 89. On p. 88 it is suggested that programmes for business applications are to a great extent written once for all for any given job: this is, we think, true only of payrolls and routine accountancy applications.

This volume should be read by all who wish for guidance on what a computer might do for a business. There is perhaps not enough about what is already being done in Britain, but as a text-book on the approach to computers, it contains many valuable pages which are unlikely to fade, because basic principles do not change. So many managements are nowadays seeking to appreciate the real significance of the computer that a British view is welcome. Chapter 14 gives details of computers available at the time of going to press. There is a good index, a glossary and a bibliography. The printers have done justice to the author's work.

H. W. G. GEARING.

(continued from page 39)

LONDON COMPUTER GROUP - ANNUAL MEETING

FUTURE PLANS

"You will recall that the Chairman indicated that the Study Group activities remain a field for the Business Group of the Society, and will therefore be run by the Business Group Committee. With regard to the programme for 1957/58, four groups from the last session have asked to continue with their existing membership and we shall certainly arrange for this.

"We shall send out to all members toward the end of the summer a questionnaire giving details of the new groups which we propose to form. This will give subject titles and a broad outline of the material which we suggest each group should cover. This will not, of course, preclude a group from widening its field of discussion.

"We shall lay some emphasis on asking groups to indicate their requirements as users for future developments in equipment.

"The subject titles which operated in the last session will be substantially similar in 1957/58, although there have been some slight changes here and there. We are also introducing some new subjects, and in particular I would like to mention statistical methods, internal and external requirements, service bureaux, and comparative programming techniques.

"In conclusion, I would like to thank our Chairman for the immense amount of work that he has done during the past year. He has been a source of strength to all members of the Committee and without his drive and encouragement we would not have progressed to the extent that we have. On behalf of the Committee I would like to thank him for his leadership.

"I have much pleasure in seconding the adoption of the Report and Accounts."

ADOPTION OF PROPOSALS

The Chairman then put the Resolution to the meeting, and the Report and Accounts, with the proposals contained therein for the dissolution of the London Computer Group as a separate entity and the integration of its interests with the British Computer Society, were unanimously adopted.

Expressing the thanks of members to the Honorary Auditor, Mr. E. F. Milne, C.A., the Chairman proposed his re-election for the period from the 1st May 1957 until the date on which the affairs of the Group had been wound up. Seconded by Mr. H.W.Gearing, this was carried unanimously.

At the conclusion of the formal business of the meeting, Mr. Lewis, seconded by Mr. Stone, moved from the body of the meeting that members should express their "great appreciation of the efforts of the Chairman, the Joint Honorary Secretaries and Committee members in the formation and administration of the Group during and prior to the period under review". This was carried with acclamation.

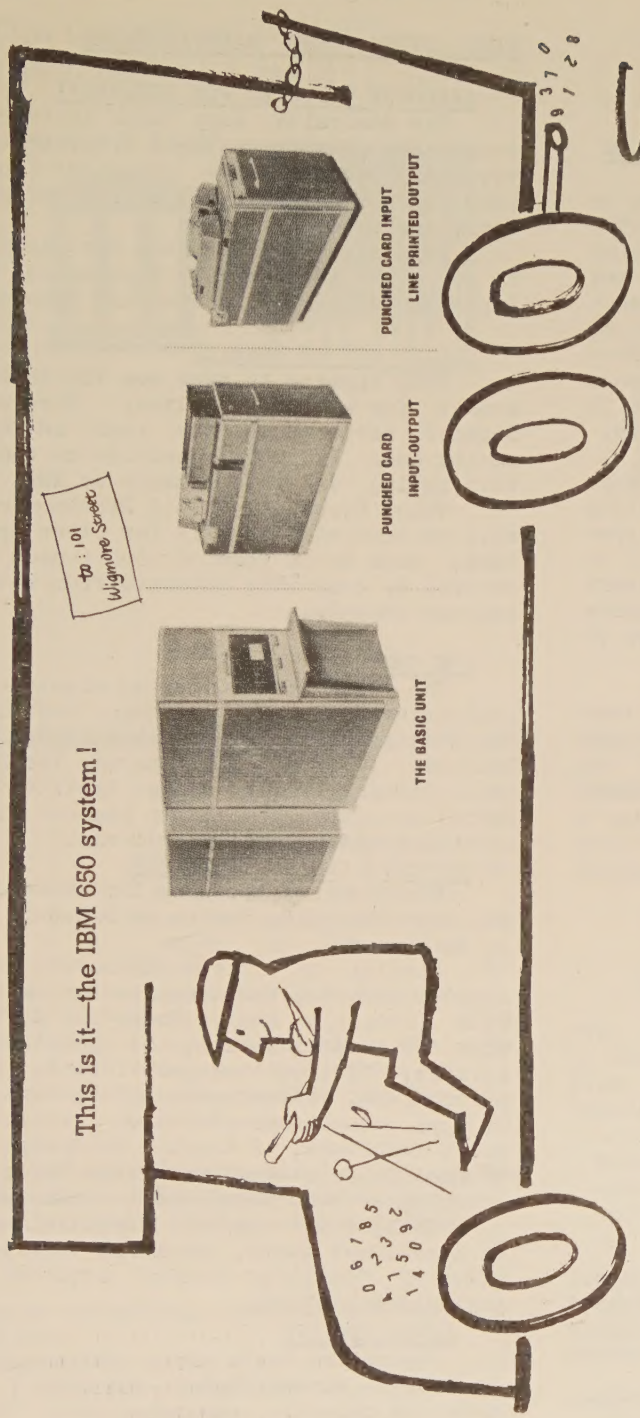
Following a break for refreshment, members listened to an illustrated talk on the Stantec Zebra Computer: the evening ended with a brief closing address by the retiring Chairman of the Group who, as Chairman of Council of the British Computer Society, introduced to the meeting some of the members of Council and of the Scientific and Engineering Group who were present.

BUSINESS GROUP COMMITTEE

The full Committee of the Business Group of the British Computer Society is ---

A.D.Booth, D.Sc., Ph.D.
T.B.Boss, B.A.
E.E.Boyles, F.C.A.
A.J.Bray, M.A., A.C.A.
L.R.Crawley, M.O.M.A., M.S.I.E., A.M.I.I.A.
R.H.Dawkes, A.C.A., A.M.I.I.A.
R.G.Dowse, A.C.A.
P.V.Ellis, A.C.I.I.
H.W.G.Gearing, B.Sc.(Econ.), A.C.I.S., F.I.S.
A.Geary, M.A., M.Sc.
D.W.Hooper, M.A., A.C.A.
J.P.Hough, A.C.A.
R.L.Michaelson, F.I.A.
R.H.W.Park
J.E.L.Rotheroe
R.E.Stevens, A.A.C.C.A., A.M.I.I.A.
A.S.Waller

At the Committee's first meeting, Mr. H.W.G.Gearing was elected Chairman, with Mr. R.G.Dowse as Vice-Chairman. Mr. A.J.Bray and Mr. J.Hough are Joint Honorary Secretaries.



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NEWS & NOTES

ELECTRONIC COMPUTER EXHIBITION AND SYMPOSIUM

An electronic computer exhibition is to be held at Olympia, London, in November 1958. Sponsored jointly by the Radio Communication and Electronic Engineering Association and the Office Appliance and Business Equipment Trades Association, the exhibition, held at the suggestion of the National Research Development Corporation, will include electronic data handling equipment of all kinds, and is the first of its kind to be held in Britain.

Concurrently with the exhibition, there is to be a symposium at which papers dealing with applications of computers will be presented and discussed. These papers will be prepared by users rather than manufacturers and it is hoped to give a comprehensive cross-section of current use of computers in business and industry.

The British Computer Society has been invited by the organising committee of the symposium to assist them in planning the symposium, and the Society's representative is taking an active part in the Committee's discussions, presenting the point of view of the user. Some 700 delegates are expected to attend the symposium.

NATIONAL PHYSICAL LABORATORY'S SYMPOSIUM

The National Physical Laboratory are planning a symposium, for the later part of 1958, limited to 200 specialists, who will be considering the mechanisation of thought processes.

INCIDENTAL INTELLIGENCE

It is understood that an eminent Council member now refers to his Titian-haired typist as "that infra-red, high density, electronic digital operator, with extremely rapid access time".

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NEWS ITEMS FROM MANUFACTURERS

ANALOGUE COMPUTER FOR ADMIRALTY

The Admiralty have taken delivery of a resistance network analogue computer (by Sunvic Ltd.) for research into heat flow problems associated with the design of gas and steam turbines.

This work is being done for the Admiralty by the Engineering Department of the Imperial College of Science and Technology.

ELLIOT 405 AT NORWICH

FRED appears to have won the inter-civic stakes for a true computer; Norwich City Council have taken the lead in handling rating data (30 000 properties on 6 magnetic film reels) and rate demands by EDP.

This Fiendishly Rapid Electronic Device will be used additionally for other applications, such as a form of continuous credit control by comparing payments from ratepayers against demands.

IBM CENTURY

The 100th IBM 700 Series electronic data processing equipment has been installed at the Whiting Refinery of Standard Oil Co. of Indiana. First applications include job order costing, labour cost distribution and payrolls; development is planned to cover inventory and production records.

BRUSSELS COMPUTING CENTRE

Electronic Associates Inc. have opened a European Computing Centre in Brussels (Rue de la Science 43).

Similar to their Pronceton and Los Angeles centres, the installation is based on PACE (Precision Analog Computing Equipment), with 120 potentiometers, 84 operational amplifiers, 12 inverting amplifiers, 20 servo multipliers, 4 electronic multipliers, 5 servo type non-linear function generators, 4 servo resolvers, 2 digital voltmeters, a 2-channel X-Y plotter, 2 portable X-Y plotters, 2 6-channel recorders, and 2 noise generators.

Charges for computer time are negotiated on a contract basis, according to the combination of "building blocks" required for a particular problem.

TOUGH TESTING

Operation tests under extreme conditions in U.S.A. showed that a Monrobot V computer survived climatic extremes from 76° below zero to 165° above with minor adjustments only. Shock mounted in an Army truck and driven 10 miles over all types of rough test roads at Aberdeen Proving Ground, one resistor was shorted.
